REMARKS

Claims 25-31 and 37-40 are rejected under 35 U.S.C. 102(b) as anticipated by US Patent No.5,808,735 to Lee et al ("Lee"). The rejection is respectfully traversed.

We believe that Lee fails to disclose processing the same information using both a first and a second threshold to provide outputs, and analyzing the outputs and classifying the anomalies in at least one classification, contrary to the opinion of the examiner. Before we examine the examiner's arguments, it is worth while to first describe the context where the above claimed features in the claim 25 are useful.

As explained in the Background of the Invention of the present application, different types of defects have different sources and different impacts on the final device yield. As a result of new planarization processes (such as chemical mechanical planarization or polishing or CMP) and other processes used in the semiconductor industry, different kinds of anomalies are introduced to the wafer surface, such as microscratches, chatter marks, slurry residue, water marks, long scratches (continuous and spiral), pits, rip-out, dishing as well as surface and embedded particles. The cause of these anomalies is explained in more detail on pages 1-3 of the present application.

Different types of defects may call for different remedies. Thus, particles can be removed by post-CMP cleaning and may have no significant impact on the final yield. Unlike particles, some of the CMP-induced defects, such as microscratches and chatter marks, cannot be removed by post-CMP cleaning and it is important to sort them out and minimize their occurrence since they may impact final yield. For the cleanable defects such as particles, the classified defect counts can be used for process control.

For the reasons above, the capability to classify the anomalies will permit a user to distinguish between microscratches from particles and other point defects and adjust the CMP or other cleaning process in real time in an on-line production process or post-

processing as required to improve yield. Lee is not able to accomplish the type of anomaly classification described above.

Lee uses the same threshold when analyzing test and reference image data from the same layer but uses different thresholds when analyzing such data from different layers. Lee uses different optimal thresholds when analyzing data from different layers because different layers can have different image properties, such as reflectance and image texture. Each of these thresholds is then used when comparing test and reference image data to detect defects in the corresponding layer for which the threshold is determined to be optimal.

Thus, according to Lee, "Different layers of a given surface are typically of different types of materials, and therefore exhibit different image properties. .... ADC system 20 takes advantage of the different image properties of different layers by separately analyzing the image properties of different layers to establish an optimal error threshold for each layer. ADC system 20 then uses these optimum error thresholds when comparing test and reference image data to achieve improved defect detection." See column 4, lines 9-19 of Lee. Lee uses a confocal optics to take images (called "slices' in Lee, and see column 4, lines 58-66) of the wafer at different Z levels, and establishes a threshold for each of the layers. See Column 6, lines 1-12.

After the threshold has been established, "defects are detected by aligning test and reference images and then subtracting the images one from the other. Intensity differences between corresponding test and reference pixels that exceed an intensity-error threshold indicate the presence of a defect." Column 5, lines 54-58. But Lee then continues: "In practice, however, test and reference images differ slightly in intensity even in the absence of defects due to imaging and process variations. ADC system 20 compensates for these normal intensity differences (step 220) by providing an intensity offset I_{OFF} so that they do not result in the erroneous detection of defects." Column 6, lines 15-20. This is done by first normalizing the detection threshold before it is used for

defect detection, as described in the sections of Lee relied on by the examiner for the rejection.

The sections of Lee (col. 6, lines 21-33, 41-56) relied by the examiner in the rejection describe nothing more than a process for normalizing the intensity differences between test and reference pixel pairs at the same x-y location to account for the differences between the test and reference pixel pairs due to "imaging and process variations" rather than any defects that may be present. Thus, the optimum threshold I_{TH} is established for each layer in step 215. Col. 6, lines 1-4. Threshold I_{TH} is used to identify the locations as having potential defects where the difference between the test and reference pixels I_{MAX} exceeds the threshold. The intensity differences at the remaining pixels is then used to create a histogram, and the peak value I_{OFF} of the histogram is used to offset the intensity of each reference pixel to normalize their values in step 220. After the normalization process, the normalized I_{MAX} is then compared in step 235 with the same I_{TH} as used in steps 215 and 220 to identify the locations of potential anomalies, which are then stored.

Thus, as can be seen from the description of the sections of Lee relied by the examiner, Lee uses the same threshold I_{TH} in the different steps for analyzing the test and reference image data from the same layer or surface rather than two different thresholds as required in claim 25. Even though Lee may employ different thresholds for different layers, these thresholds are used for processing different information from different layers, rather than the same information from the same layer.

It is believed to be well settled that in order for a reference to anticipate a claim, there must be identify of elements between those of the reference and those of the claim. Lee clearly fails this test in regard to the claim 25, since it fails to teach or suggest the use of two different thresholds to process the same information.

Furthermore, in view of the vast differences between the above-noted features of the claim 25 on the one hand, and those of Lee on the other outlined above, it is further

believed that there is no reason or motivation for one skilled in the art to modify Lee in order to arrive at the above-described features of claim 25. Claim 25 is thus believed to be allowable.

Claims 26-31 and 37--40 are believed to be allowable since they depend from allowable claim 25. They are further believed to be allowable because of the features added therein.

Thus, claim 27 contains the feature that "wherein the first threshold is higher than the second threshold, wherein one or more anomalies are classified as scratches when they are classified as scratches at the second threshold whether or not they are classified as scratches at the first threshold." This is not taught or suggested by Lee. Column 5, lines 54-67 relied on by the examiner for the rejection of claim 27 describes nothing more than that the fact that the difference in intensity between the corresponding test and reference images, in the absence of defects, will be small for smooth portions of the images, and large for rough portions of such images. Hence, the error threshold for rough areas or portions of the test and reference images should be greater than that for smooth areas or portions of the test and reference images. Even though the error thresholds for the rough and smooth areas may be different, the data from rough areas or portions of the test and reference images is still compared to a single albeit greater threshold, and the same data from smooth areas or portions of the test and reference images is also compared to a single albeit smaller threshold. We therefore believe that such section of Lee does not support the rejection.

We note with appreciation the examiner's indication that Claims 32-36 would be allowable if rewritten in independent form. This has not been done since the claims upon which they depend are also believed to be allowable.

Claims 25-40 are presently pending in the application. Reconsideration of the rejections is respectfully requested and an early indication of the allowability is earnestly solicited.

Certificate of Mailing Under 37 CFR 1.8 I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope address to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on November 29, 2004. Franklin Dyer

Respectfully submitted,

James S. Hsue 11/29/04
Reg. No. 29,545 Date

AMENDMENTS TO THE DRAWINGS

The office action objected to the drawings in that the drawings must show every feature of the invention specified in the claims, and that the features of claim 25 are not shown.

Please add new drawing sheet number 8, containing Fig. 11, showing the claimed limitations of claim 25, and renumbered drawing sheets 1/8-7/8 as indicated on the attached annotated sheets. Replacement sheets 1-8 are also attached.

The specification has been amended herein to include reference to Fig. 11. No new matter has been added.

Annotated Sheet Showing Changes

1/8

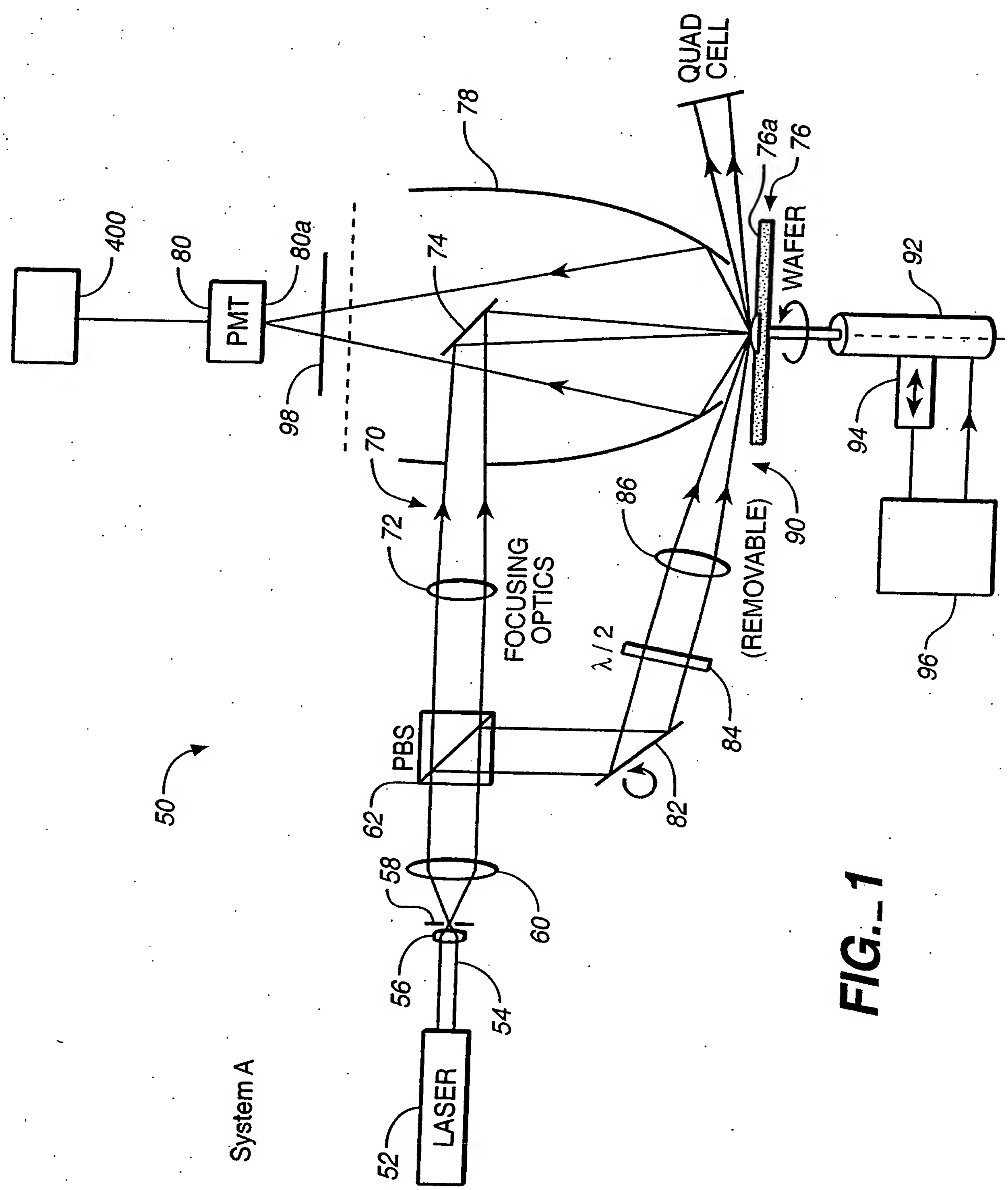


FIG._1

System A

Annotated Sheet Showing Changes

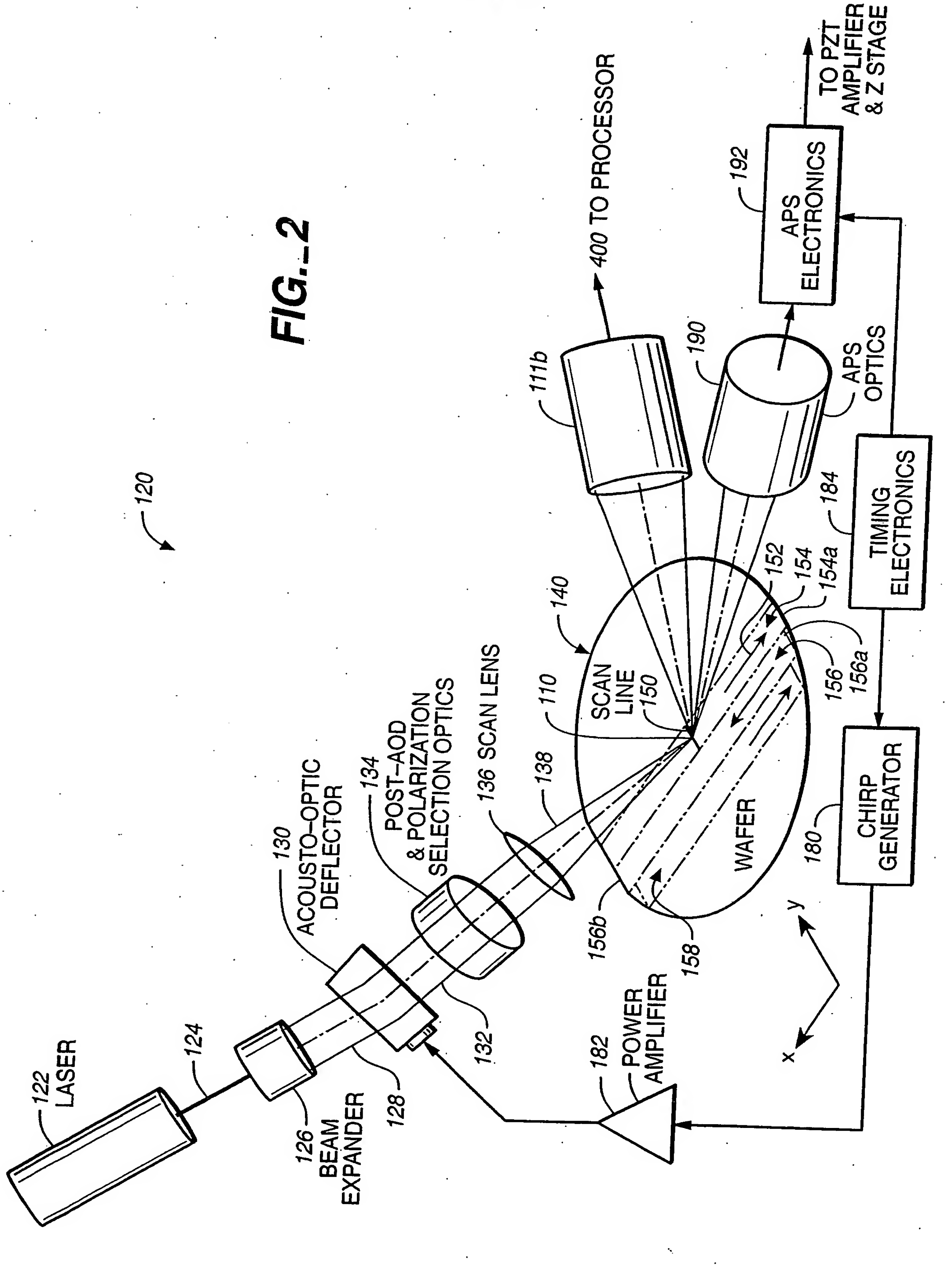
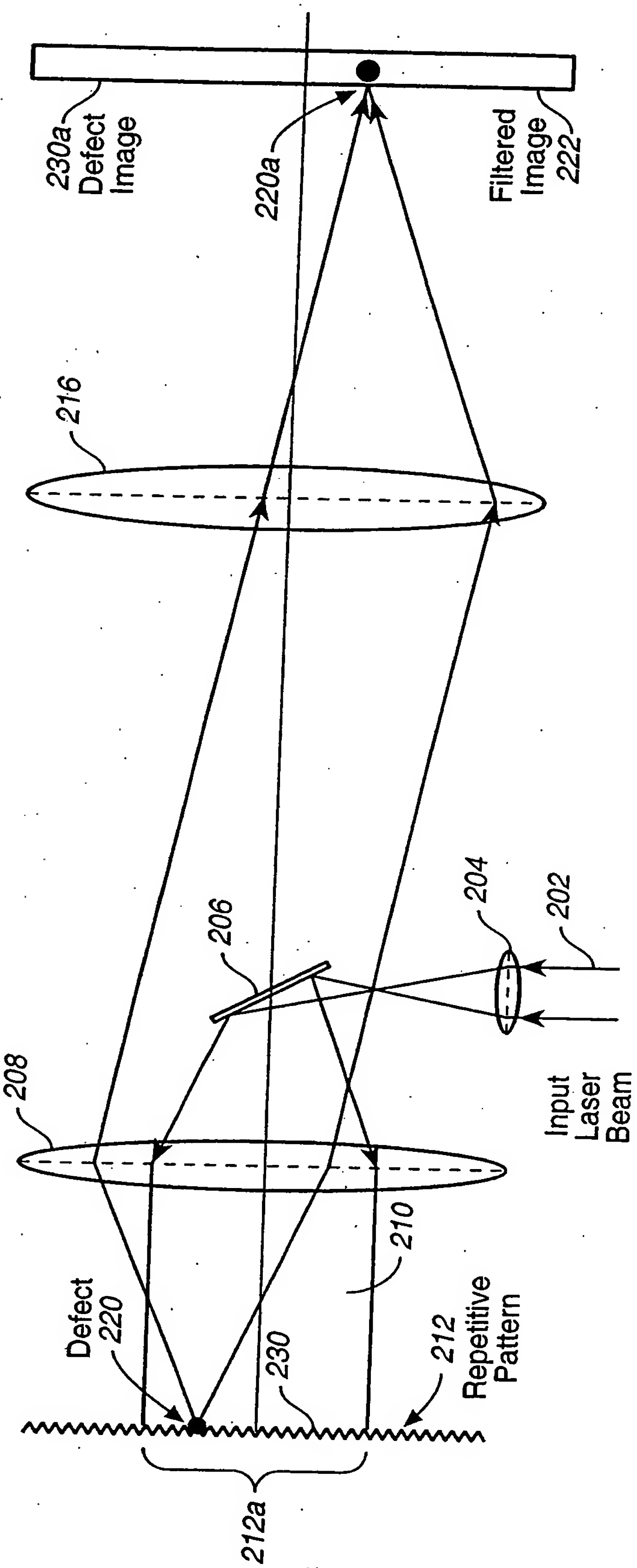


FIG._2

Annotated Sheet Showing Changes

3/~~7~~8



Optical Pattern Filtering Defect Detection

FIG._3

Annotated Sheet Showing Changes

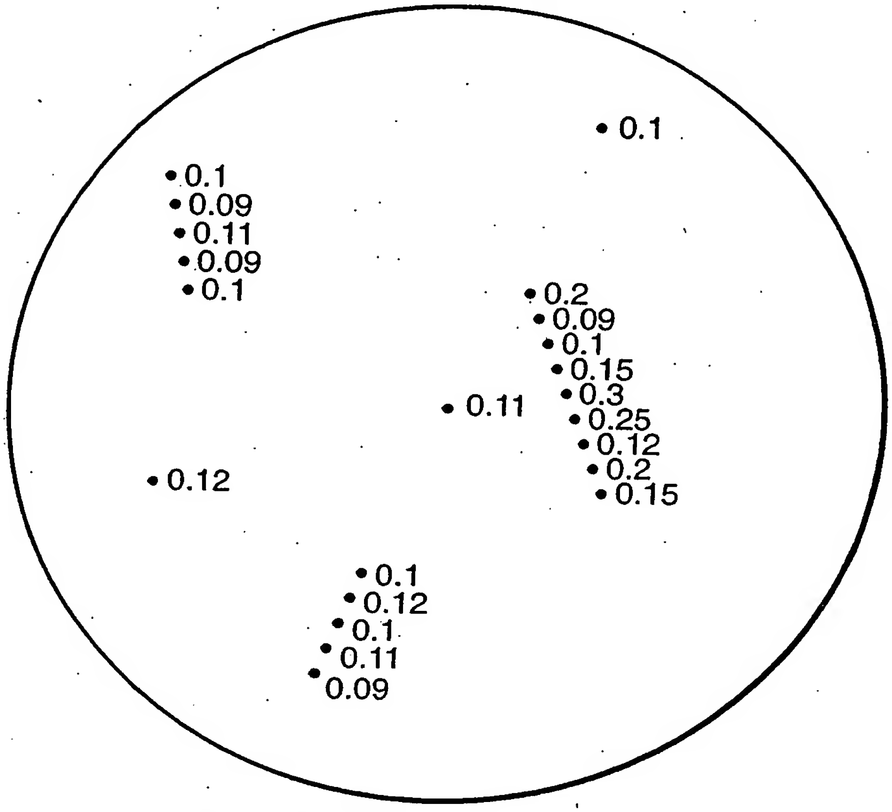


FIG._4 Simulated Distribution of Defects After a Scan. Size Indicated in Microns

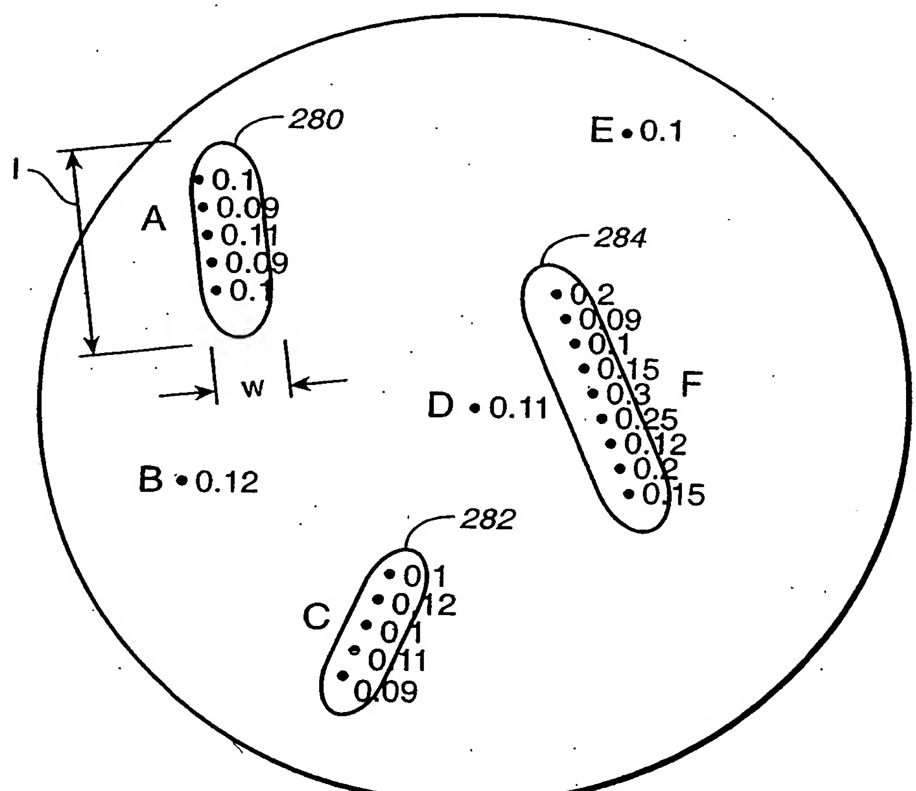
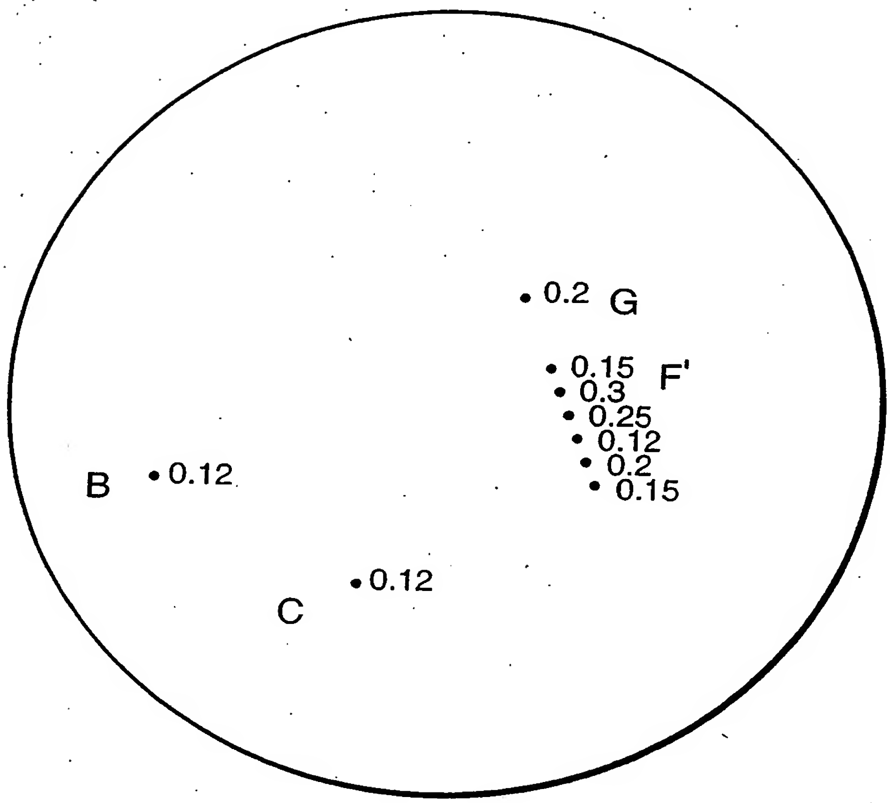


FIG._5 Initial Clustering in Microscratch Algorithm

Annotated Sheet Showing Changes

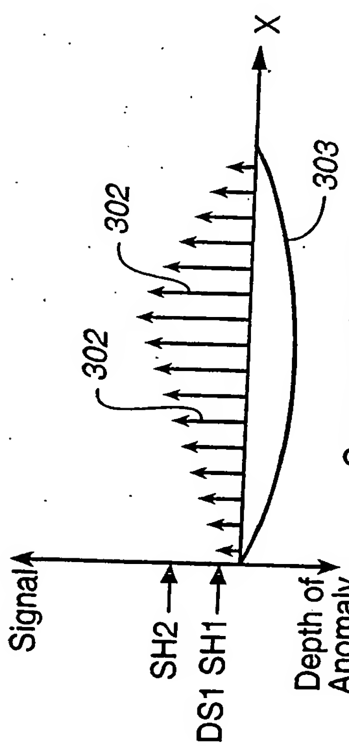


Final Output of the Microscratch Algorithm

FIG._6

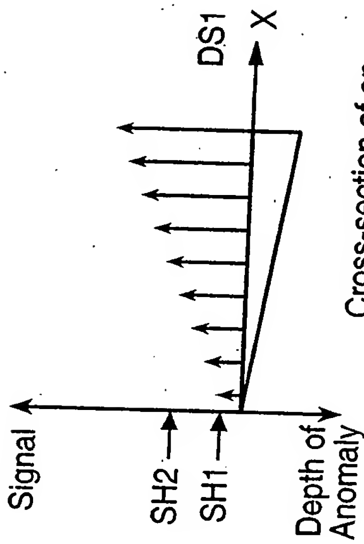
Annotated Sheet Showing Changes

6/~~7~~8



Cross-section of an Elongated Anomaly

FIG._7A



Cross-section of an Elongated Anomaly

FIG._7B

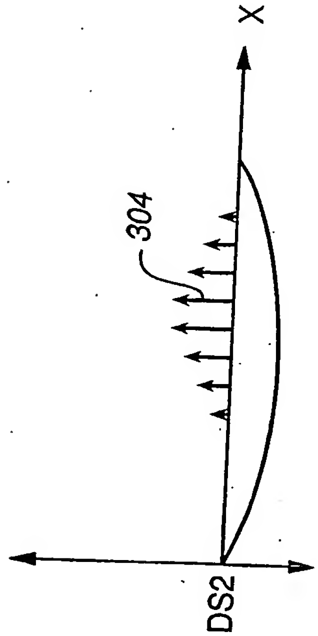


FIG._8A

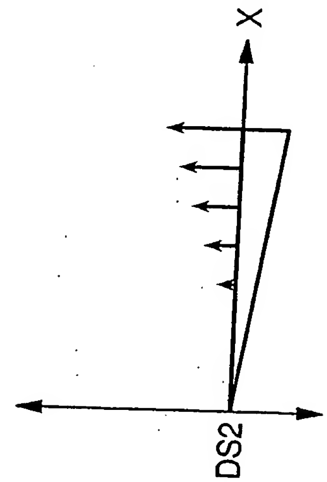
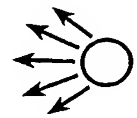


FIG._8B



Cross-section of a Non-elongated Anomaly

FIG._9

Annotated Sheet Showing Changes

7/~~7~~8

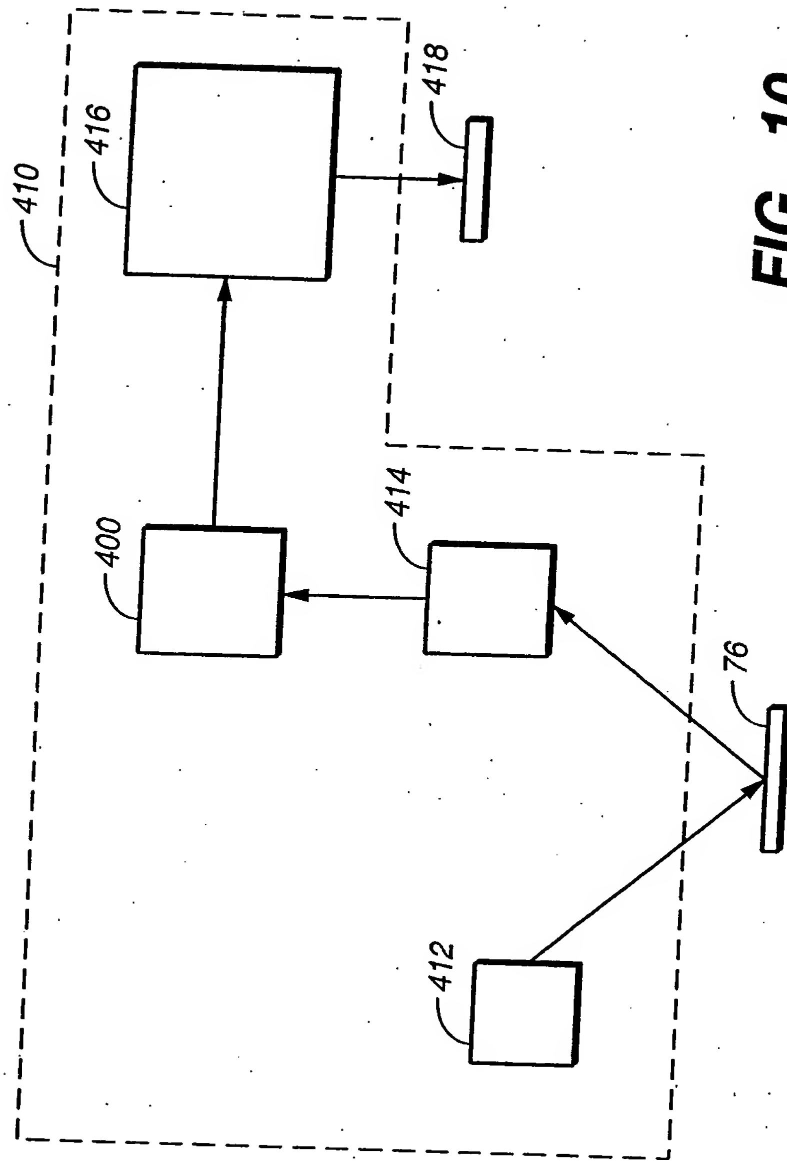


FIG._10

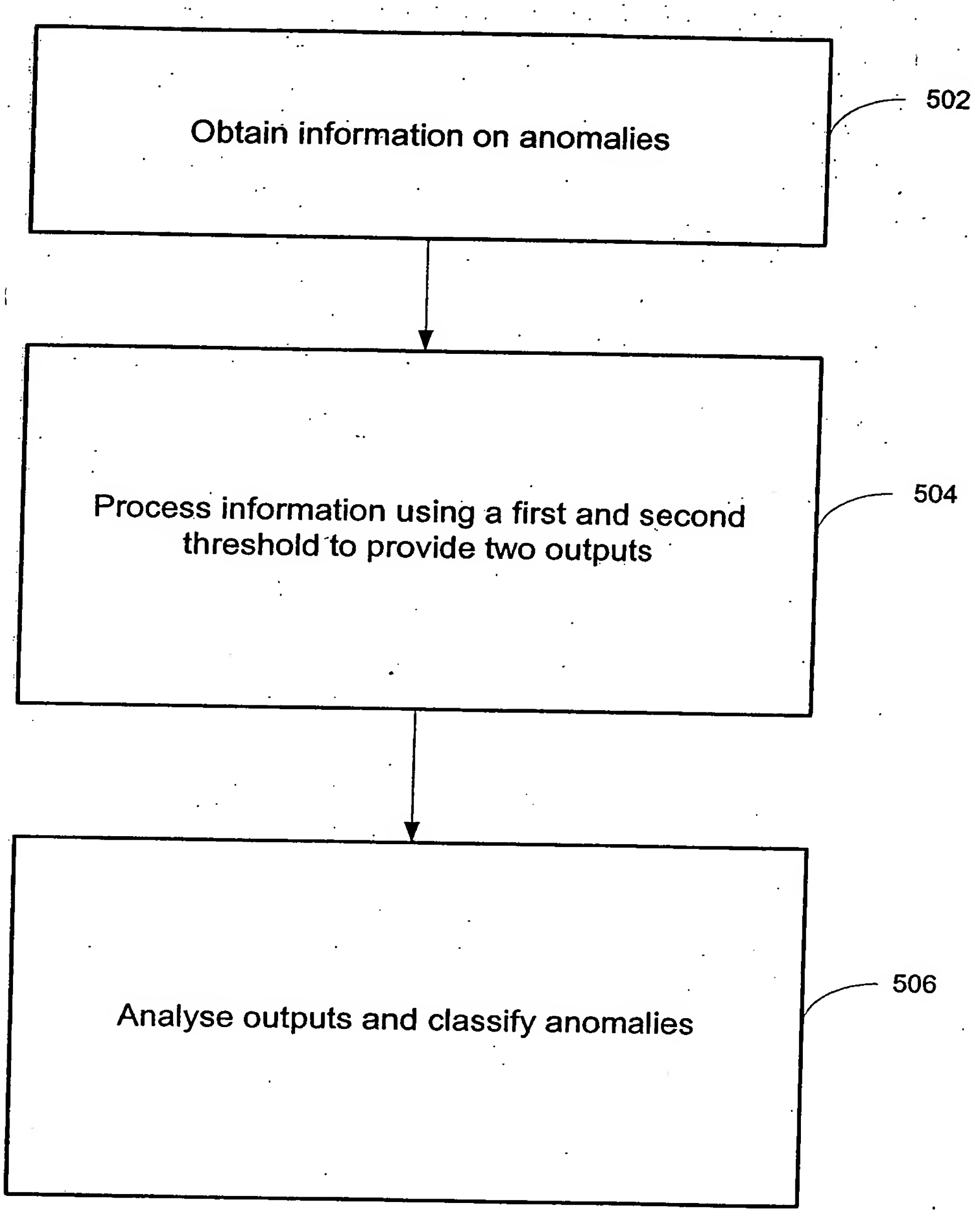

Obtain information on anomalies
502
Process information using a first and second threshold to provide two outputs
504
Analyse outputs and classify anomalies
506

FIG. 11